



IJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 Issue: V Month of publication: May 2019

DOI: <https://doi.org/10.22214/ijraset.2019.5632>

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IoT based Public Distribution System

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Abstract: *The system of providing basic domestic commodities on subsidy to poor families in developing countries like India is an important aspect to meet fundamental requirement of people. The existing public distribution system in ration shops requires manual measurement of quantity and maintenance of record of transactions. And also there is no transparency in data transportation processes from the ration shops to the Government.*

The proposed system helps to maintain transparency in data transportation processes from the retailer to the government by providing the security which is challenging task of the WSN. By using this devices manufacturer can actively monitor the transportation processes, the activities at the retailer end and verify proper handling conditions. This gives significant quality of service improvements and greater efficiency which in turn lead to lower transport cost, and reliable services to the users over a period of time along with avoiding data duplication. Also the Government can actively monitor the activities at the shop keeper's end and verify proper handling conditions.

Keywords: *Public Distribution System, Data Privacy, Avoid Data Duplication; Jaccard Similarity Algorithm, Sales Transaction, Data Privacy with AES Algorithm, User Authentication using Fingerprint sensor.*

I. INTRODUCTION

With the ever growing internet and interconnection among everything, the need for security is a demand of the time. Internet of things (IoT) which connects every object or device with networking capabilities is an area of great concern related to security. Objects include home automation sensors, medical equipments, vehicular sensors, nuclear reactors and any life critical real time sensing devices. This means that lack of security in IoT can pose a risk to human lives. IoT comprises of many heterogeneous devices which use diverse protocols. Each protocol follows different access mechanisms and security measures.

So the main objective is to provide more security and transparency to the Governments Public distribution System. The system of providing basic domestic facilities like food to poor on subsidy to in developing countries like India is an important aspect to meet fundamental requirement of people. The existing public distribution system in ration shops requires manual measurement of quantity and maintenance of record of transactions. And also there is no transparency in data transportation processes from the ration shops to the Government.

IoT based public distribution system is an automatic method of distribution of commodities to authenticated card holders. The details of transactions made are maintained in a database. Also the Government can actively monitor the activities at the shop keepers end and verify proper handling conditions.

To counter these fraudulent activities we are going to develop this system. Supply chains increasingly approachable to meet up the requirements of varying markets and client demands. We are using the fittest piece of technology that can surely make the business performance more effective.

We developed a system that helps to maintain transparency in data transportation processes from the retailer to the government by providing the security which is challenging task of the WSN. Software Defined Networking (SDN) is a forth-coming technology that attracts noticeable attention from both industry and academia recently.

By uncoupling the control logic from the closed and proprietary implementations of traditional network devices, it enables researchers and practitioners to design new innovative network functions/protocols in a much more flexible, powerful, and easier way. We believe SDN provides new research opportunities to security, and it can greatly impact network security research in many different ways. In the Proposed system with SDN technique we are applying the AES Algorithm for maintain the privacy of data as it is necessary to protect the data.

The sensor gives the sensed data system performs the comparison of the sensed data and the data entered by the user. The devices manufacturer can actively monitor the transportation processes, the activities at the retailer end and verify proper handling conditions. In addition for providing the successful authentication, biometric system is being used to check whether user is authentic user or not. To achieve the security and reliability in purposed system we make use of fingerprint detection sensor to authenticate the user.

II. LITERATURE SURVEY

In the paper published by Gaikwad Priya B. ,Prof. Sangita Nikumbh[1] the conventional paper based on ration card is replaced by smart card. The system is connected to the server through web. Every time before ration collection each user has to login into the system. This proposed system will help to avoid the corruption in rationing system to a large extent by providing transparency at each level. As there is no manual data stored in books or register, all the data is stored in database. hence it becomes easy for higher authority to cross check the data at any point. So implementing this will be really helpful to targeted poor people.

In this paper given by Anil ; Mallikarjun B S ; S. Mala[2] “IOT based smart public distribution system” proposes an automatic method of distribution of commodities to authenticated card holders. Also, the details of transactions made are maintained in a database. The users need to access to their account through the Smart phone by entering their ID and password. Once they are successfully logged in, they can view the stock availability. Automatic distribution of commodities is achieved by using DC motors controlled directly by Raspberry pi to open and close the valves.

Chaitali Chandankhede; Debajyoti Mukhopadhyay [3] explains that at the time of implementation, for identification purpose we are giving unique QR-code to each customer. This will help to keep track of their respective accounts. Customers will also receive SMS notification of their successful registration and stock allotted to them. Thus our system will help to create transparency in transactions and will also help to manage accountability.

In this given by Mrs. PadmavathiR ;K.M Mohammed Azeezulla ; P. Venkatesh ; Kanchan Kumar Mahato ; Nithin G[4] the conventional ration card is replaced by smart card (RFID based), which contains unique Aadhar identification number of all the family members, card holdertype APL or BPL which is used for user authentication to buy their ration. OTP and SMS will be sent to the cardholder and after each transaction the government data base will be updated. An alarm is used to alert and notify the government authority during theft. After customer purchases the material amounts get deducted from the registered bank account. SDN can bring noteworthy benefits to security research and it can also be combined with existing security research. The paper by Vandana C.P et al.[5] explains the overview of the current state of the IoT with the security challenges like object identification, privacy and integrity, authentication and authorization and malware in IoT. Software defined networks concept along with the Software-defined networks based IoT architecture is discussed. Also, the security mechanism based on the concepts of segment controller and gateway controllers are highlighted.

In this paper proposed by Prof. Sashikala Mishra ;Prof. Prashant Gadakh[6] a RFID tag is used that carries family member details and the customer needs to show this tag at the ration shop. The user will also have to provide thumb impression on the biometric machine. If the user is found authentic then the quantity of ration to be given to customer according to the total number of family member will be displayed on the LCD display. This smart ration card is free from theft and forgery as the information about the delivered ration will be sent directly to the government and customer through SMS gateway.

III. PROPOSED SYSTEM

In proposed system the manufacturer can monitor complete network and the activities at the retailer end and serves the items to the retailers in less time thus improving the service quality and time. In addition it provides the security by using AES encryption for leftover quantity of data sending from retailer to manufacturer. The similarity of the data can also be checked with the help of Jaccard Algorithm so that similar data is not replicated on server and we get the original data send from the retailer side. Figure 1 shows the architecture of the proposed system.

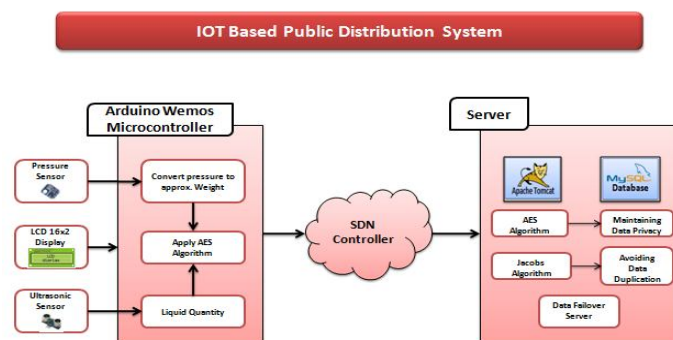
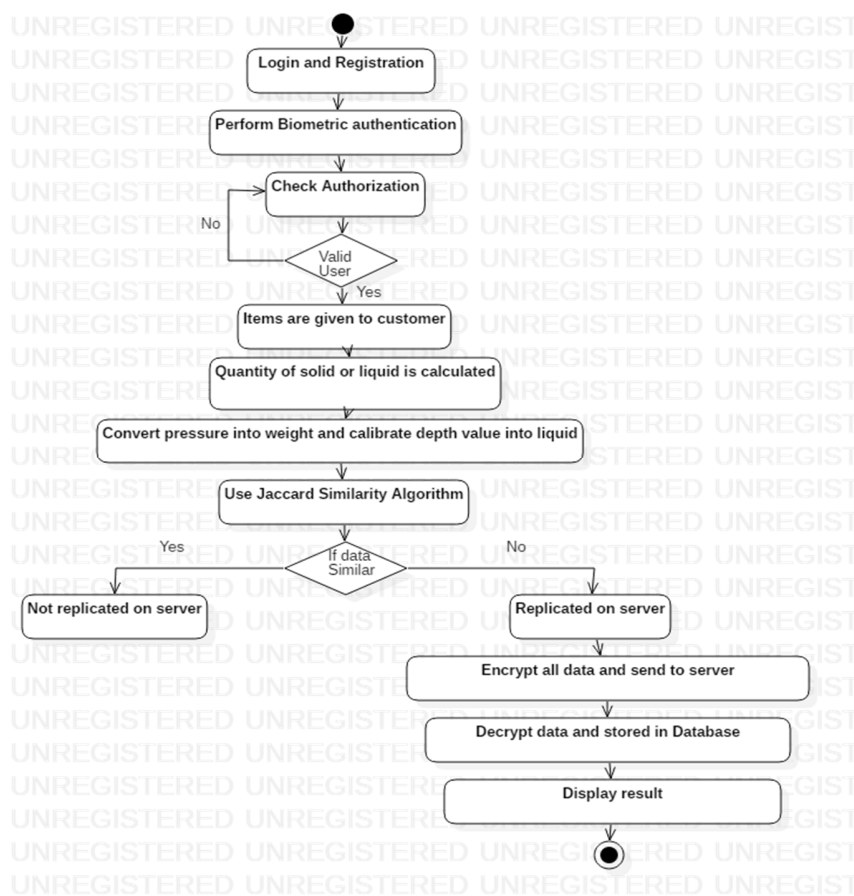


Figure 1: System Architecture

- 1) *Login & Registration:* In this phase, all users should be registration himself for system login. The Government register their warehouse itself.
- 2) *Hardware Kit Setting:* In this phase, the warehouse owner will set the hardware kit for their warehouse. Hardware kit contains the sensor for the data measurements. One kit manages the 2 types of the product i.e. one is the liquid product and second is the solid product. The ultrasonic sensor used for measuring liquid product quantity and pressure sensor used for solid product quantity.
- 3) *Get Real-Time Data through Kit:* Get the real-time data through the kit and send to the server. Both sensors will give the data according to their storage. The system will convert the received pressure sensor value into weight and calibrate the depth value into liquid quantity. After that, all sensor data will send to the server through SDN controller.
- 4) *Avoid Data Duplication:* Hardware kit will give the continuous value through the sensor. So the server will store the duplicate data. For avoiding such data duplication we use the Jaccard Similarity Algorithm.
- 5) *Maintain Data Privacy:* While sending data to the server from the hardware kit we provide the security for that data. For maintaining data privacy we use AES algorithm. AES algorithm will be used to encrypt the sensor data and then it will send to the server. And at the server side, we decrypt the data and store into to DB.
- 6) *Manage Sales Transaction:* The user will also do the manual sale transaction through their system. The companies will sale their products only to their warehouse and warehouse will send product to end user (i.e. Shops/Retailers).
- 7) *Compare Stock:* In this phase, the system will compare both manual sale transaction and kit data. The result will display in the graphical form.
- 8) *User Authentication:* The user authentication is performed using fingerprint detection sensor, where the user will get the products only once per month after being authorized.

A. System Flow

The overall flow of the proposed system is as follows





IV. ALGORITHM USED

A. AES Algorithm

1) *Encryption*: You take the following AES steps of encryption for a 128-bit block:

- a) Derive the set of round keys from the cipher key.
- b) Initialize the state array with the block data (plaintext).
- c) Add the initial round key to the starting state array.
- d) Perform nine rounds of state manipulation.
- e) Perform the tenth and final round of state manipulation.
- f) Copy the final state array out as the encrypted data (ciphertext).

Each round of the encryption process requires a series of steps to alter the state array.

These steps involve four types of operations called:

- i) Sub-Bytes
- ii) Shift-Rows
- iii) Mix-Columns
- iv) Xor-Round Key

2) *Decryption*: As you might expect, decryption involves reversing all the steps taken in encryption using inverse functions:

- a) InvSub-Bytes
- b) InvShift-Rows
- c) InvMix-Columns

Operation in decryption is:

- i) *Perform initial decryption round*
 1. Xor-Round Key
 2. InvShift-Rows
 3. InvSub-Bytes
- ii) *Perform nine full decryption rounds*
 1. Xor-Round Key
 2. InvMix-Columns
 3. InvShift-Rows
 4. InvSub-Bytes
- iii) *Perform final Xor-Round Key*

B. Jaccard Similarity Algorithm

The Jaccard similarity index (sometimes called the Jaccard similarity coefficient) compares members for two sets to see which members are shared and which are distinct. It's a measure of similarity for the two sets of data, with a range from 0% to 100%. The higher the percentage, the more similar the two populations. Although it's easy to interpret, it is extremely sensitive to small samples sizes and may give erroneous results, especially with very small samples or data sets with missing observations.

The formula to find the Index is:

$$\text{Jaccard Index} = (\text{the number in both sets}) / (\text{the number in either set}) * 100$$

The same formula in notation is:

$$J(X,Y) = |X \cap Y| / |X \cup Y|$$

Example,

- 1) A = {0,1,2,5,6}
- 2) B = {0,2,3,4,5,7,9}

Solution

$$\begin{aligned} J(A,B) &= |A \cap B| / |A \cup B| \\ &= |\{0,2,5\}| / |\{0,1,2,3,4,5,6,7,9\}| \\ &= 3/9 = 0.33 \end{aligned}$$

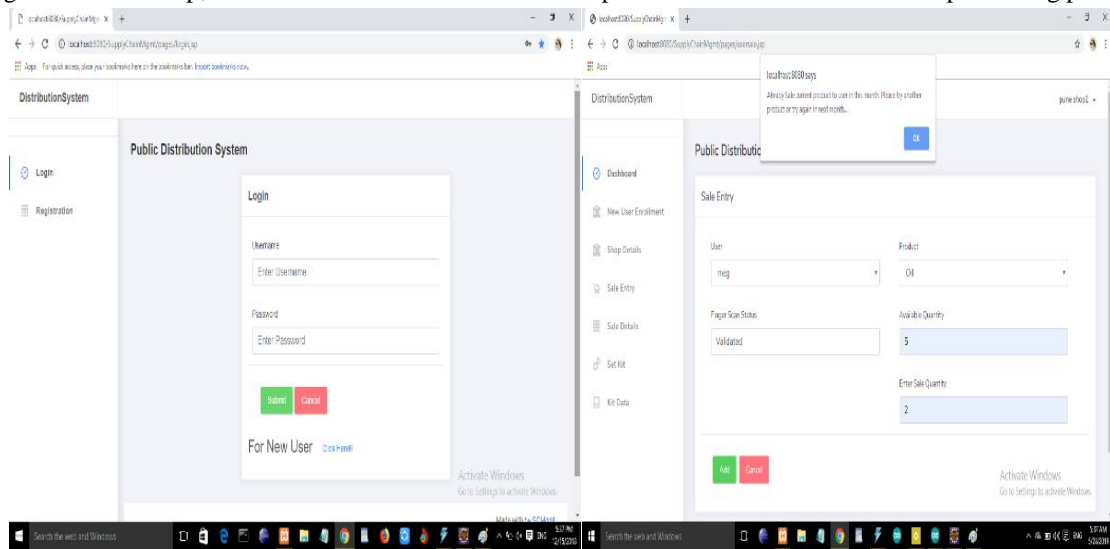
Both sets give 33.33 % similarity.

C. System Advantages

- 1) Help to maintain transparency in data transportation processes from the retailer to the manufacturer by providing the security.
- 2) System helps to provide lower transportation cost, and reliable services to the users.
- 3) Avoiding data duplication with Jaccard Similarity Algorithm.
- 4) Data privacy can be maintained using AES algorithm.
- 5) Guaranteed content delivery
- 6) Rapid provisioning of the services
- 7) User Authentication is performed with the help of user.

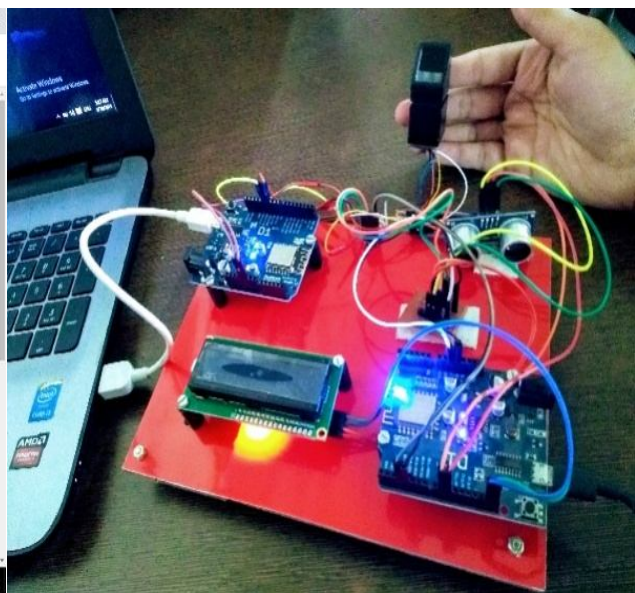
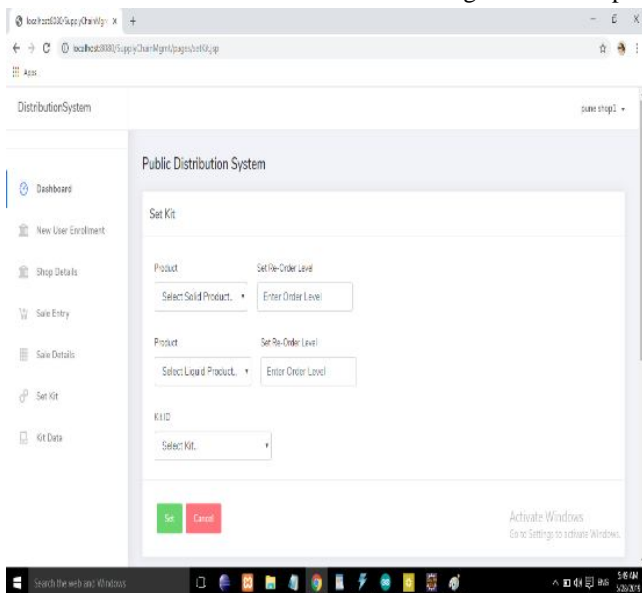
V. EXPERIMENTAL RESULTS

1. Login and Registration for Shop, Warehouse and Government from shop
2. User authentication while purchasing product



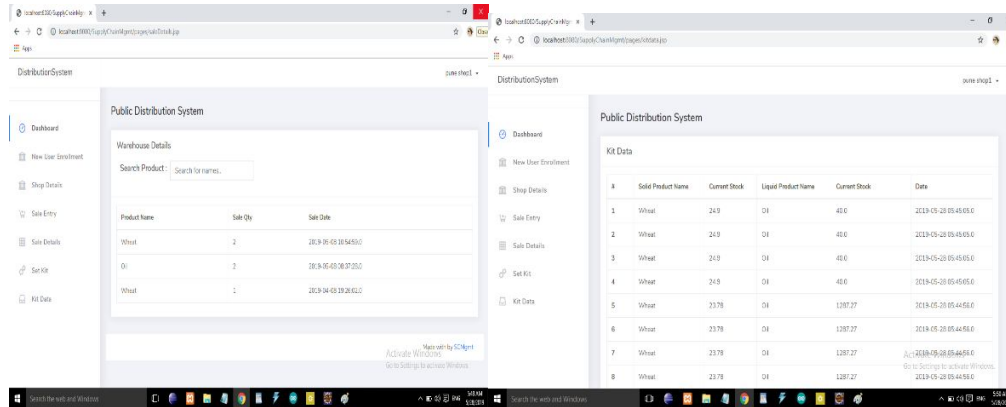
3. Setting of Kit at shop's side

4. Hardware Kit



5. Sale Details

6. Kit Data



VI. CONCLUSION

This proposed system will help to avoid the corruption in rationing system to a large extent by providing transparency at each level. It is an alternative method for monitoring the supply and distribution of grains and is focused on to bring out cost-effective, corruption free and transparent system. The system will also reduce the time consuming process for requesting of grains and other products from government warehouses. The process will verify authentic card holder using biometric system.

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